

# Determination of Distribution Products Using Matrix Saving Method in the Serang Marketing Office Area

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**Abstract**—Accuracy in sending products to customers must have a basis for scheduling and determining the right route in order to obtain optimal results. This study aims to determine the distribution route of cigarette products, analyze the optimal capacity of distributing cigarettes on the optimal route, and analyze the difference between the distance and the total cost of distribution using the saving matrix method. It is a method used to determine the distance, route, time or cost in implementation shipping goods from the company to consumers in an effective and efficient way, so the company can save costs, labor, and delivery time. Based on the results of the product distribution sequence there are 5 routes, namely route G - 5-17 17 - 14 - 7 - 6 - G has a capacity of 820 slops, route G - 4 - 16 - 1 - G has a capacity of 670 slops, route G - 13 - 15 - 12 - 11 - 10 - 9 - 8 - G has a capacity of 220 slops, route G - 2 - 3 - 8 - G has a capacity of 160 slops, and routes G - 19 - 20 - G have a capacity of 50 slops. The difference between the distance and the total cost of distribution of cigarette products is the difference between the initial distance and the proposal and the difference of 19.7 KM (12.98%) and the difference in the total cost of distribution of Rp. 10,218 per day (3.45%).

**Keywords:** scheduling, route, distance, total cost, saving matrix

## I. INTRODUCTION

The accuracy of delivery of products to customers must have a basis for scheduling and determining the right route in order to obtain optimal results, so that consumers who will be visited receive products in good condition and in accordance with the delivery time limits and consumer demand. Many routes can be chosen by the company in distributing its products, and require different costs so that it requires a method that can analyze product distribution in order to minimize based on time, distance, cost and energy.

PT.Korea Tomorrow & Global Indonesia is a foreign investment company from the South Korean country, a company engaged in the sale of cigarette products. It has 3 divisions, namely the administration division, sales division and merchandiser division. Sales division is as part of a company that sells activities, ensuring the products sold are not sold at the price according to the initial plan that has been set according to the agreement and agreement of the consumers. Sales division at PT. Korea Tomorrow & Global Indonesia has three parts namely Wholesaler, Retail Sales,

and Supermarket Sales. Wholesaler is a sales department supplying products to large stores which purchases more and for sale to small shops, retail sales are sales of parts suppliers distributing products to small shops until they are accepted by consumers, supermarket sales are sales of parts suppliers supplying to modern stores and cooperatives of company stores so that it reaches consumers.

Constraints on the distribution of product items related to weather changing factors and operational constraints of vehicles (damaged vehicles). The research objective is to determine the optimal distribution route, calculate the optimal capacity of each product distribution, calculate the ratio of initial mileage with the proposed mileage, and calculate the ratio of the total cost of product distribution from the initial total cost with the total cost of the proposed using the saving matrix method.

Saving Matrix Method is a method for minimizing distance, time or cost / cost by considering existing constraints. In the saving matrix method there are steps that must be taken, these steps are identifying the matrix (distance matrix), identifying the saving matrix (saving matrix), allocating retailers to vehicles or routes, sorting retailers (destinations) in the route that has been defined. In steps one through three are used to determine the vehicle used by retailers, while the fourth step is used to determine the route of each vehicle to get the optimal mileage. The Steps to Resolve the Saving Matrix Problem are Identifying the distance matrix, Identifying the Saving Matrix, Allocating Vehicle Stores or Routes, Sorting Stores (Destinations) in a Defined Route.[5]

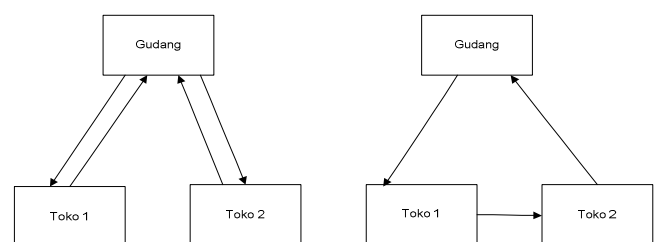


Figure 1. Determination of Optimal Routes Using Saving Matrix

Distribution is an activity to move products from suppliers to consumers in the form of a supply chain. Distribution is a key advantage to be gained by the company because

distribution will directly affect the costs of the supply chain and consumer needs, the right distribution network can be used to achieve a variety of supply chain needs ranging from low costs and high response to consumer demand.[4]

Vehicle Routing Problem (VRP) is defined as a search for efficient use of vehicles that have to travel to visit a number of places to deliver and pick up people or goods. VRP as a combination of two optimal problems namely, Bin Packing Problem (BPP) and Traveling Salesman Problem (TSP). The BPP can be described as follows: "given a number of numbers, which symbolizes the size of a number of items, and a constant K, which represents the capacity of bin. What is the minimum number of bin required? Of course, one item can only be in one bin, and the total capacity of the bin. In addition, TSP is a problem about a salesman who wants to visit a number of cities. He must visit each city only once, starting and ending with the original city. The heart of the problem is to determine the shortest path through all the cities. The relationship between the two with VRP is that vehicles can be connected to customers using BPP, and the order of vehicle visits to each customer is resolved using TSP.[6]

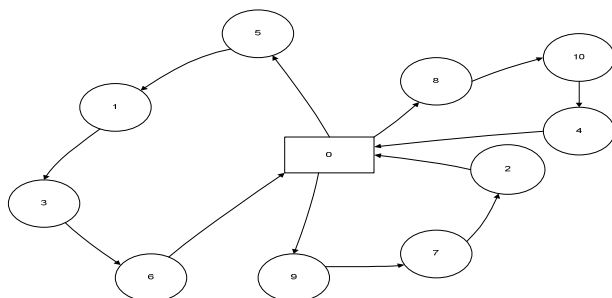


Figure 2. The solution of a VRP

## II. RESEARCH METHODOLOGY

This research was conducted at a cigarette product sales service company in the Serang-Banten area by taking a sample of the company PT. Korea Tomorrow & Globala Indonesia (AMO Serang). Data collection by observation of the company PT.Korea Tomorrow & Global Indonesia (AMO Serang) by conducting direct observations in the field and recording the required data and interviews by holding questions and answers directly to company officials to obtain more accurate data. Data processing data using the saving matrix method.

## III. RESULTS AND DISCUSSION

PT.Korea Tomorrow & Global Indonesia Opens AMO Serang office on June 22, 2017 With its address at Jalan Raya Serang - Desa Wanayasa, District Kramatwatu, Serang Regency - Banten - Indonesia to distribute products to Banten Province including Serang City, Cilegon City, Serang Regency, Pandeglang Regency and Lebak Regency. Based on consumer demand data for each product distribution where data is taken every week.

TABLE 1. CONSUMER DEMAND DATA

NO	Store	Address	Warehouse distance to the store (Km)	Demand (Slop)
1	Gunung NESTA (Store 1)	JL. Pagebangan, cilegon	6.7	50
2	Putra Mandiri (Store 2)	Pasarkelapa, cilegon	7.2	30
3	Setia Budi (Store 3)	JL. Apollo, Jombang, Cilegon	7.7	40
4	Tunas (Store 4)	Link Jombang Masjid Rt 001/001	8.4	300
5	Budi 1 (Store 5)	Pasar Kianggot, Cilegon	5.8	50

TABLE 1. CONSUMER DEMAND DATA (CONT'D)

NO	Store	Address	Warehouse distance to the store (Km)	Demand (Slop)
6	Budi 2 (Store 6)	JL. Pacar Putih Jombang Cilegon	6.5	100
7	Lady Jaya (Store 7)	JL. Raya Bonegara, Cilegon	7.1	150
8	Maju Berkah (Store 8)	JL. Raya cilegon Panggung Rawi, Cilegon	9.3	50
9	Manghi (Store 9)	Pertigaan Simpang cilegon	8.8	20
10	Walet Mas (Store 10)	JL.kenanga tamaraju cilegon	8.2	15
11	Sopyan (Store 11)	JL.Bhayangkara, sempir, cilegon	8.5	10
12	Asep (Store 12)	Kp. Kebon Dalem, purwakarta	9.7	20
13	Atomoro (Store 13)	Kp. Kaligandu, Purwakarta	12	10
14	Sopi (Store 14)	Kp. Gedong Dalem, Jombang	11	10
15	Burhan (Store 15)	Pasar Bunder, Purwakarta	13	20
16	Berkah (Store 16)	JL. Ciwedus Bagendung Cilegon	10	20
17	Riah Jaya (Store 17)	JL. Krenceng Citangkil	11	50
18	Ii Jaya (Store 18)	Kp. Delingseng, Kebon Sari citangkil	15	150
19	Nita (Store 19)	JL. Raya Anyer, kp. Kepuh Ciwandan	14	30
20	Udin (Store 20)	JL.Raya Anyer kp. Cigading	15	20
Total			195	1145

company distribution requires vehicles that must be owned by the company, the company PT. Korea Tomorrow & Global Indonesia has a grand max four-wheeled vehicle with the following capacities.

TABLE 2. VEHICLE CAPACITY

Transportation type	Capacity	Total Vehicle	Information
Grand Max Car	1.000 Slop (20 Dus)	3	Own

TABLE 3. TRANSPORTATION COST DATA DISTRIBUTION OF CIGARETTE PRODUCTS

No	Cost Type	Amount (Rp)
1	Fuel	78,858
2	Basic Salary	196.625
3	Meal	15.000
4	Communication	5.000
Total		295.483

## IV. INITIAL ROUTE DATA DISTRIBUTION

This data is to compare with the discussion that will be examined using the method, so that researchers look for previous data.

TABLE 4. INITIAL ROUTE DATA DISTRIBUTION

Route	Delivery Order	Amount of Distance (KM)
Route 1	G - 4 - 1 - 2 - 3 - 16 - G	24
	8,4 + 1 + 1,2 + 1 + 2,4 + 10	
Route 2	G - 14 - 5 - 6 - 7 - 8 - G	28,4
	11 + 3,2 + 1 + 0,6 + 3,3 + 9,3	
Route 3	G - 15 - 12 - 11 - 10 - 13 - G	36,4

	13 + 4,1 + 0,8 + 2,1 + 4,4 + 12	
Route 4	G – 18 – 9 – 17 – G	33
	15 + 4,3 + 2,7 + 11	
Route 5	G – 19 – 20 – G	29,9
	14 + 0,9 + 15	
<b>Total</b>		<b>151,7</b>

TABLE 5. PROPOSED DISTRIBUTION DATA ROUTE

Route	Delivery Order	Amount of Distance (KM)
Route 1	G – 5 – 17 – 18 – 14 – 7 – 6 – G	27
	5,8 + 5,4 + 1,6 + 5,2 + 1,9 + 0,6 + 6,5	
Route 2	G – 4 – 16 – 1 – G	18,7
	8,4 + 1,9 + 1,6 + 6,7	
Route 3	G – 13 – 15 – 12 – 11 – 10 – 9 – 8 – G	35,7
	12 + 2,6 + 4,1 + 0,8 + 2,1 + 1,4 + 3,4 + 9,3	
Route 4	G – 2 – 3 – 8 – G	20,7
	7,2 + 1 + 3,2 + 9,3	
Route 5	G – 19 – 20 – G	29,9
	14 + 0,9 + 14	
<b>Total</b>		<b>132</b>

TABLE 6. COMPARISON OF INITIAL DISTANCE AND PROPOSED METHOD DISTANCE

Route	Initial	Proposed	Difference	Persentase %
Distance (KM)	151,7 KM	132 KM	19,7 KM	12,98 %

Based on the results of calculations using the saving matrix it is concluded that the difference between the initial distance of the company with the proposed distance of 19.7 KM or 12.98% per day.

#### V. DISTRIBUTION COST CALCULATION

How to find out the calculation of costs researchers must know the initial distance data that has not used the saving matrix method so it is usual to know the costs to be incurred. In the distribution using a grand max car requires fuel (the ratio is one liter of fuel) 15 km one liter of fuel.

TABLE 7. INITIAL TRANSPORTATION COST DATA DISTRIBUTION OF CIGARETTE PRODUCTS PER DAY

No	Cost Type	Amount (Rp)
1	Fuel	78,858
2	Basic Salary	196.625
3	Meal	15.000
4	Communication	5.000
<b>Total</b>		<b>295.483</b>

To find out the cost per day researchers must know the monthly work time, amounting to 20 days, starting Monday to Friday and Saturday and Sunday holidays, so we can know the total costs incurred per day as below.

TABLE 8. PROPOSED TRANSPORTATION COST DATA DISTRIBUTION OF CIGARETTE PRODUCTS PER DAY

No	Cost Type	Amount (Rp)
1	Fuel	68.640
2	Basic Salary	196.625
3	Meal	15.000
4	Communication	5.000
<b>Total</b>		<b>285.265</b>

The use of the saving matrix method can improve the company's distribution routes so that it can reduce the company's operating costs. The use of the Farthest Insert, Nearest Insert and Nearest Neighbor methods is able to shorten the distance traveled by company transportation from the initial distance of 151,7 KM after using the saving matrix method to 132 KM and there is a difference in the distance between the initial distance and the distance using the 19,7 KM saving matrix method. For the expenditure of distribution costs from the initial data of its use Rp.295.483 per day experienced savings in the Rp. 285.265 per day so the difference between the initial distance and the distance using a saving matrix of Rp.10.218 per day.

#### VI. CONCLUSION

- The optimal route for product distribution obtained after doing calculations with the combined method of the saving matrix method for each route is as follows:  
Route 1  
Warehouse - Store 5 – Store 17 – Store 18 – Store 7 – Store 6 - Warehouse  
5,8 + 5,4 + 1,6 + 5,2 + 1,9 + 0,6 + 6,5 =27 KM  
Route 2  
Warehouse - Store 4 – Store 16 – Store 1 – Warehouse  
8,4 + 1,9 + 1,6 + 6,7 = 18,7 KM  
Route3  
Warehouse – Store 13 – Store 15 – Store 12 – Store 11 – Store 10 – Store 9 – Store 8 – Warehouse = 12 + 2,6 + 4,1 + 0,8 + 2,1 + 1,4 + 3,4 + 9,3 = 35,7 KM  
Route 4  
Warehouse - Store 2 – Store 3 – Store 8 – Warehouse = 7,2 + 1 + 3,2 +9,3 =20,7 KM  
Route 5  
Warehouse - Store 19 – Store 20 – Warehouse = 14 + 0,9 + 15 =29,9 KM.
- Based on the results of the initial distance research data obtained 151.7 KM after using the Saving Matrix method so that there is a reduction of a distance of about 132 KM and the difference from the initial distance with a distance of 19.7 KM aftershocks. If presented, around 12.98%.
- Based on the research results the initial cost of Rp. 295,483 after the Saving Matrix method so that there is a reduction in costs by Rp. 285,265 and the difference from the initial distance to the proposed distance of Rp. 10,218 per day. If presented, 3.45% per day.

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